Eversource Laminated Wood Structure Replacement Program Phase II – Revision 1

Planning Advisory Committee Meeting

October 20th, 2021

Revisions to the October 20th, 2021 Presentation

Agenda

- Background
- Project Drivers
  - Recent Structure Replacements
  - Inspection Results
- Lessons from Phase I Laminated Structure Replacements
- V191 Laminated Wood Structure Failure
- Laminated Wood Structure Geographic Locations
- Project Scope
- Summary of Work
- Appendix I: Inspection Photos

Background

- Laminated wood structures are made with untreated southern yellow pine and then placed into a pressurized tube to force chemical treatments into the wood pores
  - This treatment only penetrates about ¾" into the pole's surfaces
- In 2017, Eversource replaced deteriorating laminated wood structures that were installed in the 1970s
- Recent structure replacements have revealed additional concerns about the integrity of laminated wood structures installed between 2000 and 2014
  - The softened wood is prone to woodpecker and insect damage
  - Poles are susceptible to cracking along their length, creating points of entry for water leading to internal rot
  - Cracking also allows insects to access deeper in the structures creating further degradation
- Phase I of the Laminated Wood Structure Replacement Program was presented in March of 2021 for five 115-kV lines

Project Drivers – Recent Structure Replacements

- Cross-sectional inspections of recently-removed laminated wood structures have uncovered significant structural damage that was not detected in previous visual inspections
  - Rot present through the length of the structure and follows the voids between joints
  - Open joints at the top of the structure allow free entry of water
  - Damp wood at the center of the structure became soft with rot
  - Voids between layers are not consistent in size or location throughout the structure but were present on each cross-sectional cut
  - Additional splitting behind surface cracks for most of the length of the structure (2-4 layers into structure)
- Structure replacements performed since March 2021 PAC presentation have continued to uncover structural damage

Project Drivers – Inspection Results

- Structures are graded in accordance with Electric Power Research Institute (EPRI) Guidelines
  - *A: Nominal Defect – No Action Required*
  - *B: Minimal Defect – Monitor Degradation*
  - *C: Moderate Defect – Repair or Replace under next maintenance*
  - *D: Severe Defect – Repair, Reinforce, or Replace immediately*
- Extent of internal damage did not become visible until structures cross sections were examined after removal
  - Internal damage not visible during aerial inspections
  - EPRI does not have specific guidelines to assess internal damage or rot during ground inspection
  - Woodpecker damage and pole-top cracks accelerate internal deterioration
- Conclusion:
  - Integrity of the laminated wood structures cannot be measured by conventional visual inspection
  - Remaining strength cannot be reliably estimated because wood is rotting from within or under mounting brackets

Lessons from Phase I of Laminated Structure Replacements

- The L175 and G128 lines were presented as a part of Phase I of the Laminated Wood Structure Replacement Program
- Structures on these two lines that have been removed indicate the extreme degradation that has incurred internal to the structures, not visible from the outside

Above: G128 Line –
Slide Cracking, Rot and Insect Damage

Left: G128 Line –
Highly Degraded Laminated Wood Structures with Cracks, Internal Rot, and Insect Damage

Lessons from Phase I of Laminated Structure Replacements (cont'd)

- The degradation on the L175 and G128 indicates the poor condition of laminate wood structures across Eversource's footprint
- Many laminate wood structures show little or no signs of exterior deterioration, while the inside of poles are rotting and rapidly deteriorating

L175 Line –
Degraded Laminated Wood Structures, Internal Rot, Side Cracking, Insect Damage

Lessons from Phase I of Laminated Structure Replacements (cont'd)

- Side cracking or top rot on the poles may be indicative of far worse damage inside the structures as indicated by the cross-sections of the dismantled L175 and G128 structures
- Laminate wood structures across Eversource's footprint are beginning to show signs of cracking and degradation at the tops of poles (more photos of LWS inspections in Appendix I)

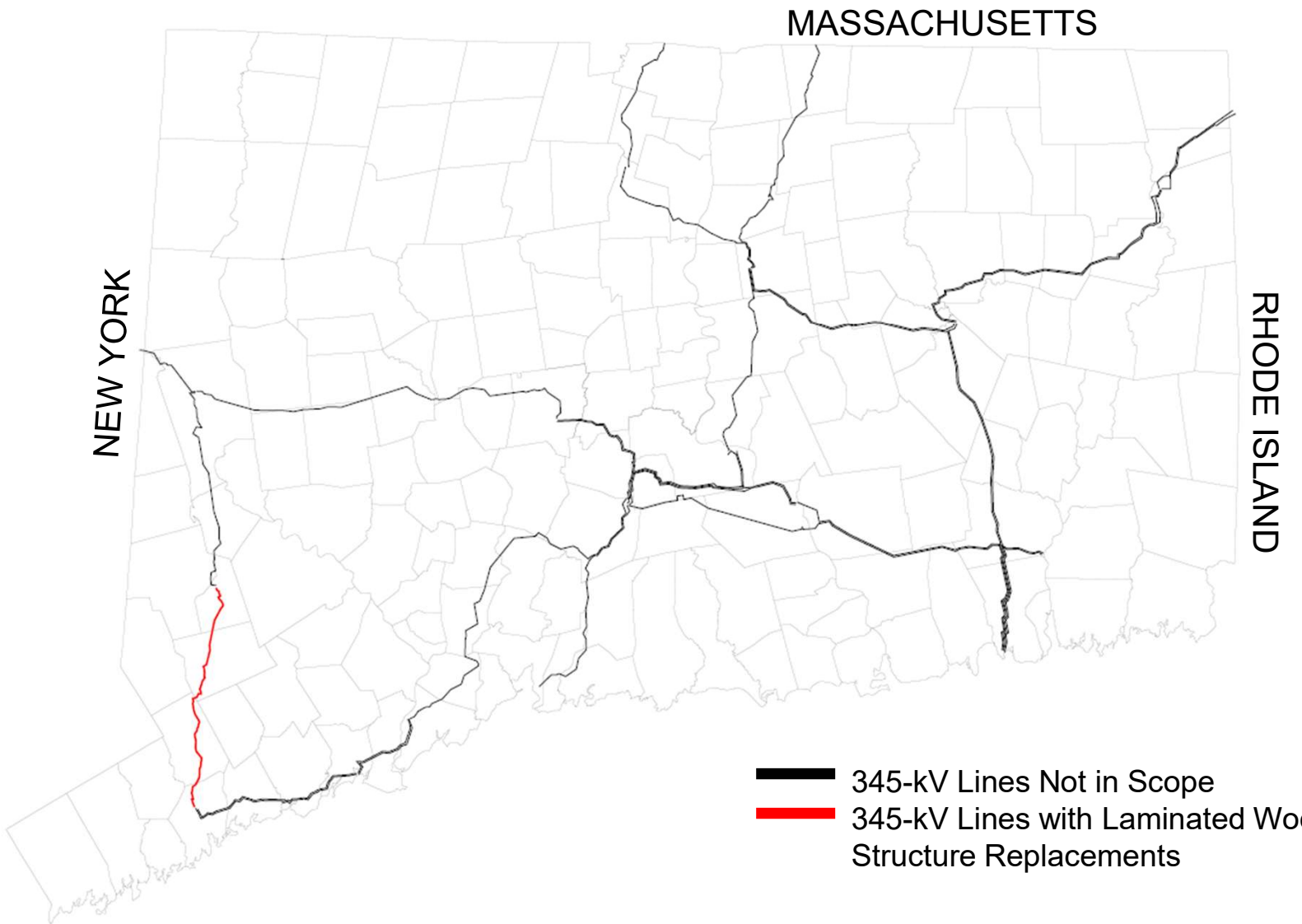
Side Crack –
S188 Line, Structure #49

V191 Laminated Wood Structure Failure

- In March of 2021, the V191 experienced a laminate wood structure failure
- The laminate structure snapped due to an internal failure above the distribution line connection on the pole
- The red boxes indicate where the structure was severed
- The structure showed only minor external signs of damage, but inside had degraded to the point of failure

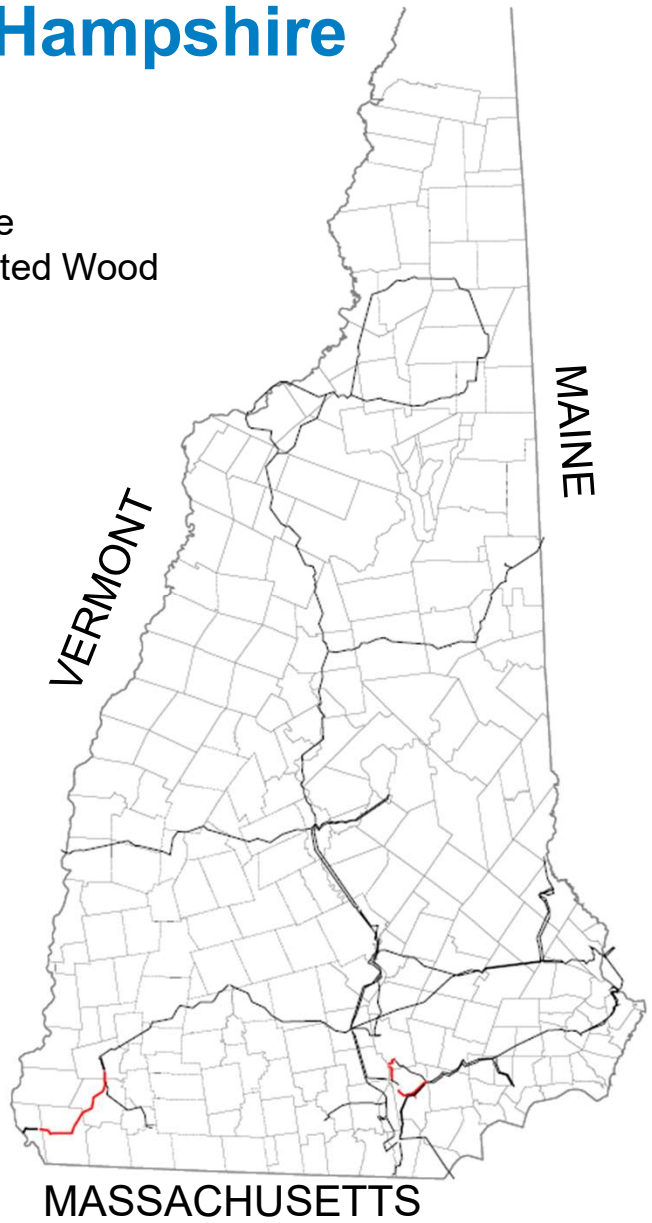
V191 Line Structure 47 –
115-kV Wires on the Ground due to
Laminated Wood Structure Failure

Laminated Wood Structure Geographic Locations - Connecticut



Laminated Wood Structure Geographic Locations – New Hampshire

115-kV Lines Not in Scope
115-kV Lines with Laminated Wood Structure Replacements



Project Scope

- Laminated wood structures (229) will be replaced across five New Hampshire 115-kV transmission lines and one Connecticut 345-kV transmission line with weathering steel monopoles, installation of lightning arrestors and counterpoise
- Benefits of weathering steel monopoles
  - Compliance with current clearance and strength code requirements
  - Improved reliability and storm resilience for all regions
  - Increased strength can support larger conductor sizes if needed in future
- Replacement schedules to be coordinated with ongoing projects to take advantage of mobilization, permitting, and outreach efforts, and access to shared ROWs
- Projects in this presentation will address priority lines
  - Additional structures removed during these projects will continue to be assessed for internal damage
  - Remaining lines with laminated wood structures will be assessed in the coming months
  - Additional structure replacement projects will be presented to PAC in 2022 for Phase III of the Laminated Wood Structure Replacement Program

Summary of Work

Line	Total Length (Miles)	Replacement LWS Structures	Total Structures**	Estimated Cost (-25% / +50%)	In-Service Date
3403*	8.63	26	77	$8.422 M	Q3 2022
R187	2.88	31	31	$7.541 M	Q1 2022
S188	3.08	32	32	$7.341 M	Q1 2022
M164	2.12	27	46	$6.024 M	Q1 2022
A152	19.96	72	242	$15.264 M	Q3 2022
V191	3.37	41	60	$11.024 M	Q1 2023
Total	-	**229**	**488**	**$55.616 M**	-

* 345 kV Line
** Remaining structures include steel and round wood

Questions

Appendix I: Laminate Wood Structures Inspection Photos

Pole Top Cracking –
A152 Line, Structure #46

Cracking Laminate Structure –
A152 Line, Structure #70

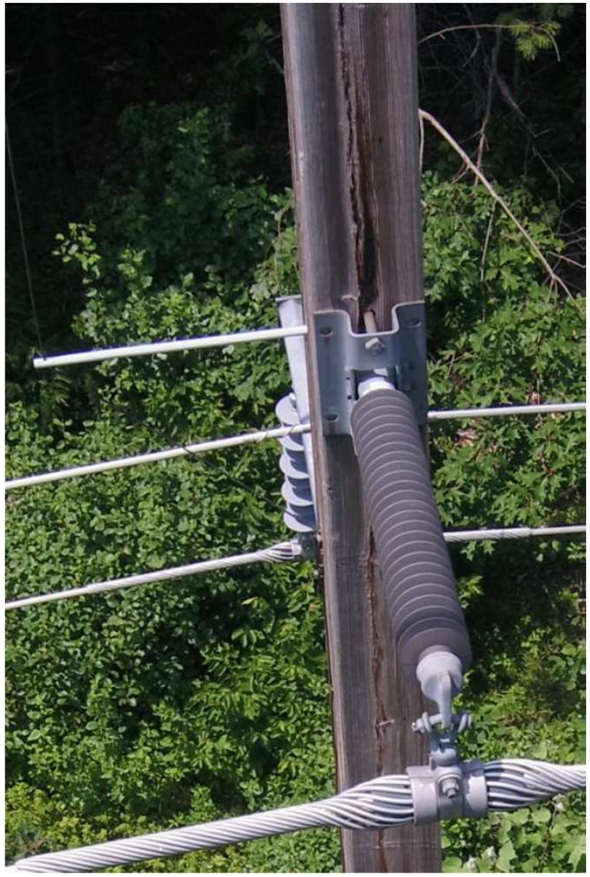
Appendix I: Laminate Wood Structures Inspection Photos

Side Cracks –
R187 Line, Structure #21

Rotting Cross Section –
R187 Line, Structure #7

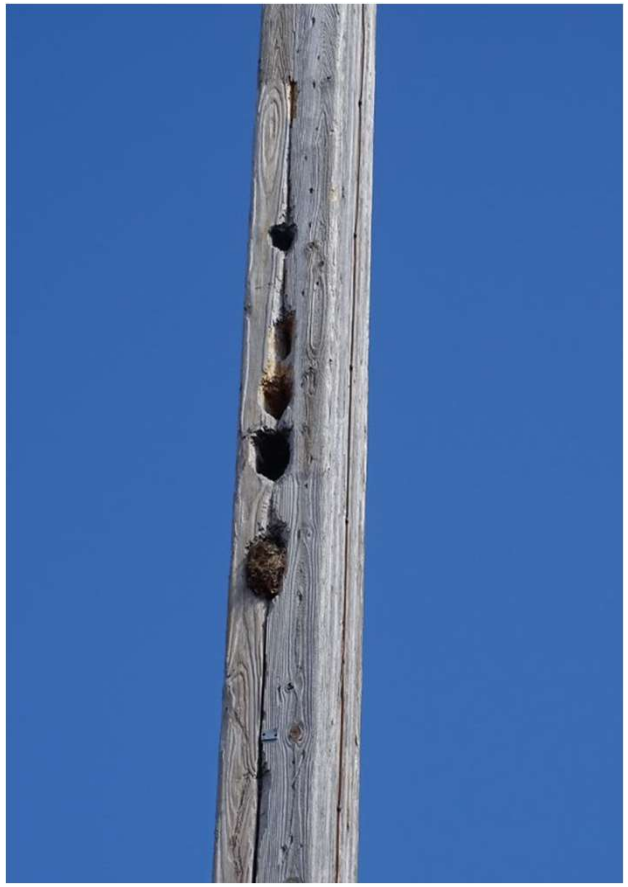
Appendix I: Laminate Wood Structures Inspection Photos

Cracking Laminate Structure –
V191 Line, Structure #47



Side Crack –
V191 Line, Structure #13

Appendix I: Laminate Wood Structures Inspection Photos



Woodpecker Damage and Cracking – S188 Line, Structure #52

Side Crack – S188 Line, Structure #49

Appendix I: Laminate Wood Structures Inspection Photos

Pole Top Rot –
M164 Line, Structure #26